



A GIS Lesson: Healthy Chesapeake?

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Teacher Lesson Plan

1.0 Major Understandings

Using GIS software applications can assist you in observing patterns in data as well as potential risks. Scientists use several indicators to monitor the quality and vulnerability of a watershed which are recorded into a database. However, without the use of a GIS it would be difficult to assess the overall health of the Chesapeake Bay watershed.

2.0 Objectives

In this investigation, student will

- Use GIS mapping software to analyze health of the Chesapeake Bay watershed.
- Use the following terms correctly and apply them to the interpretation of data: watershed, estuary, runoff, soil permeability, precipitation, conventional loads, toxic loads, contaminated sediments, ambient water quality, and GIS.
- Create and develop one map with legends emphasizing areas of concern in the Chesapeake Bay watershed.
- Analyze critical environmental factors for patterns and assess a watershed's water quality and vulnerability.

3.0 Timeline

The following is a suggested timeline for the lesson.

3.1	PowerPoint Presentation on Chesapeake Bay	10 minutes
3.2	PowerPoint Presentation on ArcIMS Application	10 minutes
3.3	GIS Lab: Healthy Chesapeake?	5 - 10 minutes
3.4	Data Interpretation and Conclusion	40 - 60 minutes
3.5	Practice using ArcIMS	10 - 15 minutes
3.6	Assessment	10 - 15 minutes

4.0 Materials

For Each Student

- 1 Copy of [Background Information: Chesapeake Bay](#)
- 1 Computer with Internet Access (ArcExplorer Application Optional)
- 1 CD with Health of the Chesapeake Bay Data Set (if no Internet Access)
- 1 Copy of [Worksheet: Health of the Chesapeake Bay Watershed](#)

For the Class

- 1 Networked Printer
- 1 Computer Projection System (optional)

5.0 State and National Standards

[Virginia Standards of Learning](#): Earth Science (ES.1, ES.3, ES.9): Life Science (LS.12): Biology (BIO.1, BIO.9): Computer Technology (C/T8.1, C/T8.4)

[National Science Standards](#): Content Standard A (Science as Inquiry); Content Standard D (Earth and Space Science); Content Standard E (Science and Technology)

6.0 Instructional Strategies

6.1 Anticipatory Set

Divide the class into groups of two students each and have them list ways that they think scientist can monitor the health of a bay or estuary.

6.2 Background Information

Present a mini-lecture using the [PowerPoint Presentation on Chesapeake Bay](#) or have the students read [Background Information: Chesapeake Bay](#).

Key Questions (Checking for Understanding)

1. Explain in your own words your understanding of a watershed.
2. Why would the Chesapeake Bay be considered an estuary?
3. What are the two categories scientist measure the health of the Chesapeake Bay?

6.3 Explanation of ArcIMS or ArcExplorer Application

Use the [PowerPoint Presentation on ArcIMS Application](#) or for advanced experienced GIS users demonstrate use of ArcExplorer Application to present a brief overview of the functions in ArcIMS or ArcExplorer and how to view themes. You can also run the application using a projector to demonstrate key features of the software.

6.4 [GIS Lab: Healthy Chesapeake?](#)

Conduct the GIS Lab. If the computers do not have internet access you may download a free copy of ArcExplorer 2 for Windows and ArcExplorer 4 JAVA Script at the [ESRI web site](#). If you are running on a Apple machine you will need the JAVA script version and your operating system needs to be OS10 or higher. Those of you who are using a windows format need just the ArcExplorer 2 for windows.

Have the students individually follow the instructions and answer Questions 1 to 10 on the [Worksheet: Health of the Chesapeake Bay Watershed](#). The students will use the ArcIMS Graphical User Interface Quick Reference as they maneuver through the data.

Next, have students pair up to complete Questions 11-13 on the lab sheet. There will be no wrong or right answers, just ideas supported by the data they have collected.

7.0 Practice

- 7.1 Practice using web-based GIS application ArcIMS at the following location [Practice](#) (currently not available but will be up and running shortly)

8.0 Closure

Restate the lesson objectives and relate to the learning experience. Ask students to state which of their activities helped them learn a major lesson objective. Re-teach if necessary. Encourage continued learning through the extensions and resources.

Have student go back to the GIS web application and create a map to analyze to see if there is a correlation to the layers 'Landuse Agricultural by Percent' and 'Agricultural Runoff Potential'. Ask if

Urban Runoff Potential is a quality or vulnerability indicator. You can have do the same for 'Landuse Urban by Percent' and 'Urban Runoff Potential'.

9.0 Extensions

- 9.1 Encourage students to extend their learning by investigating the watershed in which they live in greater detail. This can be done by going to the web site call 'Surf Your Watershed' found at www.epa.gov/surf/.
- 9.2 The **Enviromapper** is a web based application that will essentially allow the student to access the same EPA data for watersheds. Have the student go to www.epa.gov/iwi/iwimapper/enviromapper and watersheds from another state and investigate.
- 9.3 Students can also access through the web several sites that use GIS application over the web in analyzing large amounts of data. Have your students search for at least 5 sites that implement some type of GIS application over they web and have them describe the benefit of the site.

10.0 Resources

Surf Your Watershed. Surf Your Watershed is a service to help you locate, use, and share environmental information about your state and watershed.

<http://www.epa.gov/surf/>

The Chesapeake Bay Program. The Chesapeake Bay Program is the unique regional partnership that's been directing and conducting the restoration of the Chesapeake Bay.

<http://www.chesapeakebay.net/>

Chesapeake Bay and Mid-Atlantic from Space. This Web site provides background information on imperviousness and its environmental effects, and on the principles and use of remotely sensed data.

<http://chesapeake.towson.edu/>

USGS Chesapeake Bay Activities. The USGS is one of the original partners in the Chesapeake Bay Restoration Program and continue to stay active, this web site keeps you up to date on any new developments.

<http://chesapeake.usgs.gov/chesbay/>

Chesapeake Bay Remote Sensing Program. Describes how remote sensing is used to monitor the Bay.

<http://www.cbrsb.org>

Geography Network. On-line resource for finding and sharing geographic content including maps and data.

<http://www.geographynetwork.com>

Mathematics & Science Center: *Where it all adds up!* Web site of the Mathematics & Science Center with variety of information on programs and opportunities for students.

<http://mathsciencecenter.info/>

11.0 Assessment

_____ Sample items are provided for use to use in assessing students' understanding.

[Paper-Pencil Test: Healthy Chesapeake?](#)

[Product Task: Healthy Chesapeake?](#)

[Rubic for Grading Product Task](#)

The following Table of Specifications shows how the assessment items are related to the specific objectives.

Objective	Paper Pencil Test	Product / Performance
Use GIS mapping software to analyze health of the Chesapeake Bay watershed.	5, 6, 7	
Use the following terms correctly and apply them to the interpretation of data: watershed, estuary, runoff, soil permeability, precipitation, conventional loads, toxic loads, contaminated sediments, ambient water quality, and GIS.	1, 2, 8	
Create and develop one map with legends emphasizing areas of concern in the Chesapeake Bay watershed.	9, 10	Two maps attached to lab
Analyze critical environmental factors for patterns and assess a watershed's water quality and vulnerability.	3, 4	

12.0 *Teaching Tips*

For additional information on teaching this lesson, go to the following links:

[Key Questions to Check for Understanding During Instruction](#)

[Sample Answers for the Worksheet: Health of the Chesapeake Bay Watershed](#)

[Answers to the Paper-Pencil Test](#)

[Frequently Asked Questions](#)